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Docket Management Facility (USCG-2001-10486) - 4 U.S. Department of Transportation, Room PL-401 400 Seventh Street SW., Washington, DC 20590-0001

Dear Colleagues:

The Great Lakes have sustained at least 162 successful introductions of nonindigenous species (NIS). These introductions continued throughout the 1990s, despite implementation of mandatory ballast water exchange for vessels entering with ballast water. One possible reason for this pattern is the current dominance of No Ballast on Board (NOBOB) vessels entering the Seaway (~90% of inbound traffic).

Three different goals are described in the document 67 FR 10486. Given the problem in identifying which NIS will later become invasive owing to time lags or possible synergistic interactions with other species, I believe that **Goal #1 is the target** we ought to be striving to achieve to ensure full protection of the Great Lakes. While this goal seems both lofty and unobtainable today, it nevertheless is the appropriate safeguard to ensure full protection of the lakes.

Setting appropriate standards is a pressing issue that will determine the direction of course of action in the near future. A number of standards have been proposed in this document (S1, S2, S3, S4), some of which correspond with international proposals. Proposals S2 and S4 should not be used as the standard. Neither of these standards would effectively shut the door to invasions by viruses, protozoa, most species of phytoplankton, many rotifers, and other species of zooplankton whose resting stages are ≤50μm. Proposal S1 would require much lower levels of organisms in treated ballast water, but would have two limitations. First, it would not ensure removal or inactivation of some microbes, leaving open the lakes' vulnerability to invasion by potentially pathogenic taxa. Second, unless the standard were implemented against the untreated density rather than the highest concentrations recorded in the literature, it would effectively allow for removal of much less than 95% of live organisms.

Of the proposed standards, \$3 appears to offer the highest level of security against future invasions. It mandates removal of both large and small organisms, while recognizing that that the latter are more difficult to remove quantitatively. A 99% removal of organisms — including their resting stages — will not ensure that no future ballast water invasion occur, but it is clearly the most appropriate level of treatment proposed. The literature regarding inoculum size and probability of establishment is not well developed, however the few studies that have addressed this topic have reported that invasions are more likely to succeed when 'propagule pressure' is high than when it is low. Thus, the greater the removal of organisms from the incurrent stream, the greater the level of protection afforded the Great Lakes.

It is clear that some of the technologies undergoing trails today are incapable of meeting the S3 standard. Rather than lowering the standard to meet the level of current technology, we should encourage technological developments to reach an effective standard.

We have just completed a fault tree analysis of species in Eurasia that pose a risk of invasion to the Great Lakes. Factors considered in our analysis included a history of invasiveness in Eurasia, salinity tolerance, and ability to survive under adverse conditions associated with ballast tanks. This analysis revealed 33 species of invertebrates that pose a high risk of invasion (possess all of the necessary capabilities outlined above) and additional 48 species that pose a lower risk (possessed everything but the capability to produce resting eggs). This list of high and low risk species will grow as we include more areas of the world from which ships arrive to the Great Lakes. We also have a paper forthcoming in the Canadian Journal of Fisheries and Aquatic Sciences that attempts to model propagule pressure for vessels that do not exchange ballast, for those that exchange ballast, and for NOBOBs entering the Great Lakes from either the North Sea or Baltic Sea. Our analysis suggests that ballast exchange reduces propagule pressure by about 4 orders of magnitude (depending on the salinity tolerance of the species) relative to vessels with unexchanged ballast, and that an individual NOBOB vessel likely contains more live freshwater zooplankton than would a ship with exchanged ballast water. Collectively these studies indicate that there exist many species in key Eurasian ports that pose an invasion risk to the Great Lakes, and that propagules (live individuals or their resting stages) are arriving to the Great Lakes in all three categories of vessels described above.

If you have any questions, please feel free to contact me.

Sincerely,

Hugh J. MacIsaac